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IS : 1885 (Part 1) - 1961

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Indian Standard

ELECTROTECHNICAL VOCABULARY

PART I FUNDAMENTAL DEFINITIONS

Sixth Reprint NOVEMBER 2000

(Incorporating Amendments No. 1 and 2)

UDC 001.4 : 621.3.01

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 9 *JUNE 1962*

Indian Standard

ELECTROTECHNICAL VOCABULARY

PART I FUNDAMENTAL DEFINITIONS

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Indian Standard

ELECTROTECHNICAL VOCABULARY

PART I FUNDAMENTAL DEFINITIONS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 23 December 1961, after the draft finalized by the Electrotechnical Standards Sectional Committee had been approved by the Electrotechnical Division.

0.2 The definitions contained in this standard (Part I) have been drawn up with the object of striking a correct balance between absolute precision and simplicity. The principal object of the standard (Part I) is to provide definitions which are sufficiently clear so that each term is understood with the same meaning by all electrical engineers and it does not, therefore, constitute a treatise on electrical engineering. Thus, it may sometimes be felt that the definitions are not sufficiently precise, do not include all cases, do not take account of certain exceptions or are not identical with those which may be found in other publications designed with other objectives and for other readers. Such imperfections, which will be eliminated as far as possible in later editions of the standard, are inevitable and should be accepted in the interest of simplicity and clarity.

0.3 This standard (Part I) follows to a large extent the definitions recommended by the International Electrotechnical Commission (IEC) as contained in its Publication 50(05) International Electrotechnical Vocabulary (2nd edition): Group 05 Fundamental Definitions, which represents the consensus of international opinion on the subject.

0.4 It has not been found practicable to prepare the vocabulary as a complete volume. The work is, therefore, being issued in several parts each containing one or more sections.

1. SCOPE

1.1 This standard (Part I) defines fundamental terms used in electrotechnology.

2. GEOMETRIC CONCEPTS

2.1 Alternating Field — (Under consideration).

2.2 Axial Vector (in 3-Dimensional Space) — A vector representing a physical phenomenon having direction, but symmetrical with regard to a plane normal to the vector. The attribution of a direction to the vector on its axis may only result in a complementary convention (for example, Ampere's observer, Maxwell's corkscrew rule, etc).

***Examples*:**

A vector representing a rotation in space, the moment of a force in Mechanics, etc.

2.3 Circulation (of a Vector) — The line integral of a vector round a closed curve.

2.4 Conservative Flux — The flux of a vector is said to be conservative when it has the same value for all orientable surface limited to the same contour.

2.5 Curl Field — A vector field in which the curl is not everywhere zero.

2.6 Divergence — The scalar quantity equal to the limit of the flux which emerges from a closed surface, divided by the volume contained by the surface when its dimensions become indefinitely small.

2.7 Equipotential Line, Surface or Volume — A line, surface, or volume of which all points have the same potential.

2.8 Field

a) *In a Qualitative Sense* — A region in which certain phenomena occur.

b) *In a Quantitative Sense* — A scalar or vector quantity the knowledge of which allows the effects of the field to be evaluated.

NOTE — It may happen that the word " field " is used in both senses in the same article.

2.9 Flux Linking a Coil — The sum of the fluxes linking the turns forming the coil.

2.10 Flux Linking a Turn — The flux across any rotatable surface of which the turn forms the circumference. This term is, of course, only applicable to conservative fluxes.

2.11 Flux of a Vector — The integral of the product of each clement of a surface, on which a positive and a negative face can be distinguished (called orientable surface), by the component of the vector in the direction of the positive normal to the element.

2.12 Irrotational Field — A vector field in which the curl of the vector is everywhere zero.

2.13 Line Integral (of a Vector) — The integral of the product of each element of a line along which a positive direction has been fixed, and the tangential component of the vector.

2.14 Line of Force — A line which is tangent at all points to the direction of the corresponding vector.

2.15 Polar Vector (in a Plane or in Space) — A vector representing a physical phenomenon having direction, which is also symmetrical with regard to the axis of the vector (in a plane) or to any plane passing through the axis (in space).

Examples:

Vectors representing a displacement, a linear velocity, a force, etc.

2.16 Potential Gradient — A vector of which the direction is normal to the equipotential surface, in the direction of decreasing potential, and of which the magnitude gives the rate of variation of the potential.

2.17 Potential (in an Irrotational Field) — Potential Function — A scalar or pseudoscalar quantity the gradient of which, with sign reversed equals the given vector.

2.18 Pseudoscalar Quantity — A quantity represented by a single numerical value which associates it with a unit (as in the case of scalar quantities) but of which the sign depends on the orientation of the axes. To express it adequately, it is necessary to use an anti-symmetrical tensor, of the 2nd order (in a plane) or the 3rd order (in 3-dimensional space).

Examples:

1) *In a Plane:* angular velocity
2) *In Space* : imaginary magnetic masses in the Coulomb theory

2.19 Rotating Field — A field which is constant with regard to a given rotating reference system.

2.20 Rotation or Curl (of a Vector) — A vector the flux of which across any infinitely small surface is equal to the circulation of the given vector round the contour of the surface.

2.21 Scalar Product — Dot Product — The product of the moduli of two vectors by the cosine of the angle between them.

2.22 Scalar Quantity — A quantity which is completely represented by single numerical value which associates it with a unit of measurement.

2.23 Solenoldal Field — A field in which the divergence is zero. From this it follows that the flux of the vector of such a field remains constant across sections of the same tube of force.

2.24 Tube of Force — A portion of space enclosed by all the lines of force which intersect a closed contour.

2.25 Uniform Field — A field of which the intensity and direction are the same at all points of the space under consideration.

2.26 Unit Tube — A tube through which unit flux passes.

2.27 Vector Field — A field of which the state at each point is represented by a vector.

2.28 Vector Potential of a Solenoidal Vector — A vector of which the curl is equal to the given solenoidal vector.

2.29 Vector Product — Cross Product — A vector perpendicular to two given vectors and having as modulus the product of their moduli and the sine of the angle between them, in that sense in which it is necessary to observe them in order that the first vector may turn clockwise through an angle less than 180° before it is superposed on the second.

2.30 Vector Quantity — Vector — A quantity which has direction as well as numerical value.

3. PERIODIC PHENOMENA

3.1 Alternating Quantity — A periodic quantity of which the mean value during a period is zero.

3.2 Angular Displacement — The angle formed by two homologous parts of two systems revolving in synchronism.

3.3 Angular Frequency — The product of the frequency of a sinusoidal quantity and the factor 2.

3.4 Aperiodic Circuit — A circuit in which it is not possible to produce free oscillations.

3.5 Aperiodic Phenomenon — A phenomenon approaching a steady condition without oscillations.

3.6 Cycle — The complete range of states or values through which a phenomenon or periodic function passes before repeating itself identically.

3.7 Damped Sinusoidal Quantity — A quantity which varies according to the product of a sinusoidal function and a function of absolute value decreasing with the independent variable.

3.8 Forced Oscillation — An oscillation of which the frequency is determined by a generating system.

3.9 Form Factor of a Symmetrical Alternating Quantity — The ratio of the rms value to the mean value during a half-period (beginning at zero).

3.10 Free Oscillation — The oscillation of a system in the absence of any exterior force.

3.11 Frequency — Reciprocal of period.

3.12 Frequency Band — A range of frequencies included between two limits.

3.13 Harmonic Compenents Develpoment terms of periodic function in the Fourier series.

3.14 Harmonic Content — A function obtained by subtracting the fundamental wave from a non siuusoidal periodic function.

3.15 Harmonics — Sinusoidal quantities of which the frequency is a whole multiply of a frequency selected as fundamental

3.16 In Opposition — This term is applied to two sinusoidal quantities of the same frequency, when a phase difference of half a period exists between them

3.17 In Quadrature — This term is used with reference two sinusoidal quantities of the same frequency, when a phase different of a quarter of a period exists between them.

3.18 Instantaneous Value — The value of a variable quantity at a given instant

3.19 Lead (Lag) Between One Sinusoidal Quantity and Another of the Same Frequency — The angle by which one sinusoidal quantity leads (lags) another sinusoidal quantity of the same frequency.

3.20 Mean Value of a Periodic Quantity — The mean value of a quantity during a period.

3.21 Oscillating Quantity — A quantity alternately increasing and decreasing.

3.22 Peak Value — The maximum of the ???.on a quantity during a given interval.

3.23 Period — The minimum interval of the independent variable after which the same characteristics of a periodic phenomenon recur.

3.24 Periodic Quantity — A quantity which is reproduced identically at equal intervals of the independent variable (time, space, etc).

3.25 Phase Displacement (Between Two Sinusoidal Quantities) — The difference between the phases of these quantities at a given instant of time.

3.26 Phase of a Sinusoidal Quantity — The variable angle in the sinusoidal representation of the quantity.

3.27 Pulsating Quantity — A periodic quantity of which the mean value is not zero.

3.28 Relative Harmonic Content — Distortion Factor — The ratio of the rms value of the harmonic content to the rms value of the non-sinusoidal quantity.

3.29 Resonance — The phenomenon presented by an oscillating system in which the period of the free oscillations is the same as that of the forced oscillations.

3.30 rms (Effective) Value of a Periodic Quantity — The square root of the mean of the squares of the values of the quantity during a complete period. When alternating voltages or current is mentioned, it is always their rms value which is meant unless some indication is given to the contrary.

3.31 Sinusoidal Quantity — A quantity varying according to a sinusoidal function of the independent variable.

3.32 Symmetrical — Alternating Quantity — An alternating quantity of which the values are repeated at the end of a half-period but with reversed sign.

3.33 Synchronism — Identity of frequency and phase between two sinusoidal phenomena.

3.34 Sypchronization — The process by which the emf of two synchronous machines, not mechanically connected, are brought into synchronism and phase.

3.35 Total Amplitude of Oscillation of a Periodic Quantity — The difference between the maximum and the minimum value of the quantity during one period.. (Usually called ' double amplitude ' in the case of sinusoidal oscillations.)

4. STUDY OF WAVES

4.1 Attenuation — The progressive diminution in space of certain quantities characteristic of a propagation phenomenon.

4.2 Beat — A periodic variation in the amplitude of an oscillation resulting from the combination of two oscillations of slightly different frequencies.

4.3 Critical Damping — The damping which corresponds with the limiting condition between an oscillating and an aperiodic state.

4.4 Damping— The progressive diminution with time of certain quantities characteristic of a phenomenon.

4.5 Damping Coefficient — The logarithmic decrement divided by the interval of time between two successive maxima of the same sign.

4.6 Density of the Total Electromagnetic Energy — The electromagnetic energy divided by the volume.

4.7 Dispersive Medium — A medium in which the phase velocity is a *function of* the frequency.

4.8 Distortion — Deformation of a wave or of a periodic phenomenon in the course of transmission.

4.9 Electric (Magnetic) Doublet — Electric (Magnetic) Dipole — An arrangement of two equal quantities of electricity (magnetism) of opposite signs, concentrated at two points infinitely near together.

4.10 Electromagnetic Wave — A wave which gives rise to electromagnetic phenomena.

4.11 Group Velocity — The velocity of displacement of beats produced by the superposition of two or more plane sinusoidal waves of slightly different frequencies, propagated freely in the same direction. The group velocity as thus defined is equal to the differential coefficient of the frequency with respect to the reciprocal of the wave-length.

4.12 Logarithmic Decrement — The nepierian logarithm of the ratio between the amplitude of successive oscillations of the same sign.

4.13 Longitudinal Wave (Transverse Wave) — A wave characterized by a vector parallel with (at right angles to) the direction of propagation.

4.14 Moment of a Dipole — The product of one of the quantities of electricity or of magnetism and the vector passing from the second quantity of electricity or magnetism to the first.

4.15 Phase Velocity (or Wave Velocity) of a Progressive Periodic Wave in an Isotropic Medium — The velocity with which a point (or a line or a surface) of a given phase advances in the direction of propagation of the wave.

4.16 Plane Sinusoidal Wave — A plane progressive wave such that the corresponding physical quantities vary sinusoidally with time.

4.17 Plane Wave — A wave in which the wave-fronts are everywhere parallel planes normal to the direction of propagation.

4.18 Polarisation of a Medium — The change in the physical state of the medium by which certain phenomena shown by the medium taken on a vectorial character.

4.19 Polarised Radiation — Radiation in which the condition shows certain asymmetries in respect of the axis of propagation (for example, plane, elliptical, circular polarization, etc).

4.20 Poynting Vector — A vector, the flux of which through any surface represents the instantaneous electromagnetic power transmitted through this surface.

4.21 Free Progressive Wave (Free Wave) — A wave in a homogenous medium not influenced by the boundary effects of the medium.

4.22 Propagation Constant — A complex quantity characterizing the attenuation and phase change per unit of length of the current or voltages which are propagated along a uniform line supposed to be infinitely long.

4.23 Radiation — The emission of energy or of particles of matter.

4.24 Standing Wave — A state of vibration in which oscillatory phenomena at all points are governed by the same time function, with the exception of a numerical factor, varying from one point to another.

4.25 Time Constant of an Exponential Quantity — The time after which the quantity would reach its limit, if it maintained its initial rate of variation.

4.26 Velocity of Energy Transmission — The energy flux per unit area divided by the energy density.

4.27 Velocity of Wave — The distance through which the wave is propagated in a short interval of time divided by the duration of the time interval.

4.28 Wave — A modification of the physical state of a medium which is propagated as a result of a local disturbance.

4.29 Wave Front (of a Progressive Periodic Wave) — The loci of all points for which the phase of the disturbance is the same at any instant.

4.30 Wave-Length — The distance between two successive points of a periodic wave in the direction of propagation, in which the osculation **has** the same phase.

4.31 Wave-Train — Train of Waves — A group of successive waves.

5. MACHINE CHARACTERISTICS

5.1 Efficiency — The ratio of the useful output to the input.

5.2 Energy — A physical entity which is present in a system in different forms, transformable one into the other, for example: mechanical, electromagnetic, chemical, thermal and radiant.

The energy is called 'potential' when it depends solely on the configuration and on the physical and chemical state of a system.

The energy is called 'kinetic' when it depends solely on the move ments of its different parts.

5.3 Losses—The differences between input and the useful output of a system (energy, power, quantity of electricity, etc).

5.4 Material Mass — The momentum divided by the velocity.

5.5 Mechanical Force — Any physical cause capable of modifying the condition of movement or of rest of a body or of deforming it.

5.6 Power

a) *Mean Power*—Work (or energy) divided by the time in which this work (or energy) was produced or absorbed. In periodic phenomena the average power during a period is generally taken.

b) *Instantaneous Power* — The limit of the average power when the interval of time considered becomes infinitely small.

5.7 Work — The physical entity which is measured by the line integral of the force along the path taken by the point of application of the force.

6. CONSTITUTION OF MATTER

6.1 Atom—The smallest particle of an element, in the neutral electric state, which enters into chemical combinations.

6.2 Atomic Mass — Atomic Weight — The mass of an atom divided by one-sixteenth of the mass of an atom of oxygen.

6.3 Atomic Nucleus — The central part of an atom possessing a positive charge, and containing nearly all the mass of the atom.

6.4 Atomic Number — The number of elementary positive charges of the nucleus of the atom. The atomic number represents the rank of the element in the Mendeleieff classification.

6.5 Chemical Equivalent — The atomic mass divided by the valency.

6.6 Deuteron — A nucleus of deuterium or heavy hydrogen constituted by the combination of a proton and a neutron.

6.7 Electricity — A physical agent, subject to the law of conservation of energy, which plays a fundamental part in the atomic constitution of matter. It has two forms known as positive electricity and negative electricity.

6.8 Electron — Negatoa — An elementary particle containing the smallest negative electrical charge. Its mass is approximately equal to 1 /l 837 of the mass of a hydrogen atom.

6.9 Fast Neutron — A neutron of high velocity, that is, which attains an appreciable fraction of the speed of light.

6.10 Gram Atom —The mass of an element which, when expressed in grams gives the same number as the atomic weight.

6.11 Gram Equivalent — The mass of a substance, in grams, measured by its chemical equivalent.

6.12 Gram Ion — The mass of an ion of which the value in grams is expressed by a number equal to the sum of the atomic weights of which the ion is composed.

6.13 Gram Molecule — The mass of a substance of which the value in gram is expressed by the same number as its molecular mass.

6.14 Ion — An atom, molecule or group of molecules possessing an electric charge.

6.15 Ionization— The formation of ions by the division of molecules or by the addition or removal of electrons from atoms, molecules or groups of the latter.

6.16 Ionization Energy — The minimum energy necessary to able an electron, to ionize by impact a molecule or an atom which is not excited.

6.17 Ionization Potential — The potential difference necessary to impart to an electron, initially at rest, the minimum energy necessary to enable it to ionize by impact a non-excited molecule or atom which is at rest.

6.18 Isotopes — Forms of an element of which the nuclei have the same number of protons and different numbers of neutrons. Two isotopes thus have the same atomic number and different mass numbers. They have the same chemical properties but different physical properties. Their atomic weights differ by integral numbers.

6.19 Mass Number of a Nucleus — The total number of protons and neutrons which the atomic nucleus contains.

6.20 Meson -— A particle of which the mass is intermediate between that of the electron and that of atomic nuclei. This particle is produced either directly or indirectly in large-scale nuclear reactions. There are several mesons which differ in their mass, electric charge, spin. They are unstable and their average life is less than one microsecond. In certain cases they can be transformed from one to another.

6.21 Molecular Mass — Molecular Weight — The mass of a molecule divided by one-sixteenth of the mass of an atom of oxygen.

6.22 Molecule — The smallest particle of a substance which exists in a free state and exhibits the chemical properties of the substance.

6.23 Neutron — An elementary particle having no resultant charge and the mass of which is approximately equal to that of a proton.

6.24 Positive Electricity (Negative Electricity) — Electricity which is similar to that produced by rubbing a piece of glass (resin) with silk (flannel).

6.25 Positron - Positive Electron — An elementary particle having a charge of electricity equal to that of the electron but of opposite sign, and having a mass of the same order.

6.26 Proton — An elementary particle containing the smallest positive charge of electricity and possessing a mass of the same order as the mass of the hydrogen atom.

6.27 Slow Neutron— A neutron the velocity of which is of the same order as the velocity of molecular agitation at normal temperatures.

6.28 To Ionize — To produce ions.

6.29 Valency — The number of atoms of hydrogen or of other equivalent substance which an atom or group of atoms can replace in a chemical combination.

7. ELECTROSTATICS

7.1 Capacitance of a Capacitor — The charge on one of the capacitor plates divided by the potential difference between them, the influence of any other conductor being negligible.

7.2 Capacitance of a Conducting Body — The charge of the conducting body divided by its potential, all other conductors being assumed to be infinitely distant.

7.3 Capacitance of a Conductor (in the Presence of Other Conductors) — The charge of a conductor divided by its potential, all other conductors assumed to be at zero potential.

7.4 Capacitor — A system of two conductors (plates) separated over the extent of their surfaces by an insulation medium which is capable of storing electrical energy as electrical stress.

7.5 Charge of a Capacitor

a) The quantity of electricity carried by one of the plates.

b) The action or phenomenon by which equal quantities of electricity, but of opposite sign, are collected on the two plates.

7.6 Charge on an Electrical Body— The excess of the total quantity of electricity of one sign over the total quantity of electricity of the other sign.

7.7 Conductor — A substance or body which allows current of electricity to pass continuously.

7.8 Coulomb's Law — The law according to which the force exerted in a homogeneous, isotropic medium, infinite in extent, between two quantities of electricity concentrated at two points, is proportional to these quantities and inversely proportional to the square of their distance apart.

7.9 Density of **Surface Charge** — Limiting value of the quotient obtained by dividing the charge distributed over the surface of a body by the area of the corresponding element of surface.

7.10 Density of Volume Charge — Limiting value of the quotient obtained by dividing the charge at a point by the element of volume which contains it.

7.11 Dielectric — A material medium in which an electric field can exist in the stationary state.

7.12 Dielectric Hysteresis — The phenomenon by which the polarization of a dielectric depends not only on the intensity of the field at a given instant, but also on preceding values.

7.13 Dielectric Losses — The energy, converted into heat in a dielectric subjected to a variable electric field.

7.14 Dielectric Polarization — The change, of a vector character, undergone by a dielectric under the influence of an electric field.

7.15 Dielectric Viscosity — The phenomenon by which variations in the polarization of a dielectric lag behind those of the field which produces them, the lag depending on the speed of the variations.

7.16 Discharge of a Capacitor — The operation by which the opposite charges on the two plates are neutralized partially or entirely.

7.17 Displacement — The vector which in an isotropic medium has the same direction and sense as the electric field and a magnitude equal to the product of the field by the permitivity.

7.18 Disroptive Discharge — The whole of the phenomena accompanying the perforation of a dielectric when the potential difference between two conductors exceeds a certain limit.

7.19 Disruptive Voltage — The voltage necessary to product a disruptive discharge between two conductors.

7.20 Electric Charge — Synonym for quantity of electricity.

7.21 Electric Field — The space in the neighbourhood of a charged body or of a varying magnetic field throughout which the electric charge would experience a mechanical force.

7.22 Electric Field Strength — Electric Field Intensity — A vector the value of which equals the force exerted on a quantity of electricity divided by this quantity and the direction of which is that of the force.

7.23 Electric Flux — Flux of the displacement vector.

7.24 Electric Strength — The property of a dielectric which opposes a disruptive discharge. It is measured by the intensity of the electric field which will break down the dielectric.

7.25 Electrification — The development of electric charges in a medium.

7.26 Electrocapillarity — That part of science which deals with electro-capillary phenomena.

7.27 Electrocapillary Phenomena — Phenomena depending on the variation in surface tension at the boundary of two liquids with the potential difference established between these two liquids.

7.28 Electrode — A conducting element used for conveying current to and from a medium.

7.29 Electrostatic Potential — A scalar quantity the gradient of which, with reversed sign, gives the value of the electric field and its direction.

7.30 Electrostatic Pressure — The force exerted by the electric field on the charge of an element of the surface of a conductor, divided by the area of that element.

7.31 Electrostatics — That part of the science which deals with the phenomena associated with electricity at rest.

7.32 Electrostriction — The variation of the dimensions of a dielectric under the influence of an electric field.

7.33 Insulating Material — Insulant — A substance or body, the conductivity of which is zero, or, in practice, very small.

7.34 Insulating Property — A general term used to indicate the suitability of a substance to act as an insulant.

7.35 Insulation

a) All the insulants used in the construction of a machine or an apparatus.
b) Condition of being insulated.

7.36 Kerr Effect — The phenomenon of double refraction produced in certain transparent dielectric media by an electric field.

7.37 Neutral State — The state of a body or a system in which the total quantities of electricity of the two signs are equal.

7.38 Permitivity — Dielectric Constant — A constant giving the influence of an isotropic medium on the forces of attraction or repulsion between electrified bodies.

7.39 Photo-Electric Effect — The emission of electrons caused by the action of light or other short-wave electromagnetic radiations.

7.40 Piezo-Electricity — The phenomenon of polarization caused in certain crystals by variations in mechanical pressure.

7.41 Plate of a Capacitor — Each of the two conductors separated by the insulating medium, the whole' constituting the capacitor.

7.42 Polarization — A vector quantity representing the state of dielectric polarization of a medium, and defined at each point of the medium by the dipole moment of the volume element surrounding that point, divided by the volume of that element.

7.43 Pyro-Electricity — The phenomenon of polarization caused in certain hemihedral crystals by an inequality of temperature.

7.44 Relative Permittivity — The ratio of the permittivity of a dielectric to that of a vacuum.

7.45 Semi-Conductor — A non-metallic conductor of electrons. There are different kinds of semi-conductors, intrinsic, extrinsic, N type, P type, ionic and mixed.

7.46 To Insulate — To guard one conductor against possible contacts between it and other neighbouring conductors by appropriate use of insulating materials.

8. ELECTROKINETICS

8.1 Alternating Current — A periodic current of which the mean value is zero.

8.2 Anode — The electrode by which the current in a system enters, that is, by which the electrons leave the medium.

8 3 Asymmetrical Conductivity — A property possessed by some substances of conducting electric currents more easily in one direction than in the other.

8.4 Back Electromotive Force (Back EMF) — The electromotive force which tends to oppose the normal passage of current.

8.5 Cathode — The electrode by which the current in a system leaves, that is, by which the electrons enter the medium.

8.6 Conductance — The reciprocal of resistance.

8.7 Conduction Current — The current produced by the circulation of electrons or ions in a conducting medium.

8.8 Conductivity (Qualitative) — The property which certain bodies have of conducting electricity.'

8.9 Contact Electromotive Force — The electromotive force due to contact between two bodies in different physical states, or having different chemical compositions.

8.10 Continuous Current — Direct Current — An unidirectional current which is constant or sensibly constant.

8.11 Convection Current — The current caused by the transport of electricity by material masses in an insulating medium.

8.12 Current — The elementary quantity of electricity flowing through a given section of a conductor divided by the corresponding indefinitely small time.

8.13 Current Density — A vector of which the integral over a given surface is equal to the current flowing through the surface. The mean density in a linear conductor is equal to the current divided by the cross-sectional area of the conductor.

8.14 Eddy (Foucault) Currents — The currents induced in the interior of conducting masses by variations of the magnetic flux.

8.15 Electric Circuit — An arrangement of bodies or media through which a current can flow.

8.16 Electric Current — The movement of electricity in a medium or along a circuit. The direction of the current is accepted as opposite to that of the motion of negative electricity.

8.17 Electric Flux — The differential coefficient of the electric flux density in a dielectric with respect to time.

8.18 Electrokinetics — That part of science which deals with the phenomena of electricity in motion exclusive of the magnetic phenomena which result.

8.19 Electromotive Force (emf) — The cause or action capable of maintaining electric differences of potential between two points of an open circuit, or a generating as electric current in a closed circuit. In an open circuit, the electromotive force is measured by the potential difference that it maintains. In a closed circuit, it is equal to the instantaneous power developed, divided by the value of the current in the circuit.

8.20 Electronic Current — A current produced by the movement of free electrons.

8.21 Hall Effect — Non-uniformity of the electric conduction in a conductor caused by magnetization normal to the current density vector's. The latter, instead of being parallel to the electric field, forms an angle with it.

8.22 Inductive Circuit — A circuit of which the inductance is not negligible in the particular condition under consideration.

8.23 Ionic Current — A current produced by a movement of ions.

8.24 Joule Effect — The production of heat due to the passage of electric current through a homogeneous conductor.

8.25 Joule's Law — The law according to which the power developed in the form of heat in an homogeneous conductor is proportional to the product of its resistance and the square of the current which passes through it.

8.26 Kirchhoff's Laws

a) *First Law* — The algebraic sum of the currents meeting at a node of a net work is zero.

b) *Second Law* — The algebraic sum of the emfs in a closed circuit is equal to the alegebraic sum of the potential drops due to the resistance.

8.27 Non-Inductive Circuit — An electric circuit of which the inductance is negligible in the particular condition under consideration.

8.28 Ohm's Law — The law which, in the case of direct currents, expresses the proportionality between the current and the total emf in a closed circuit, or between the current and the potential difference between the ends of a circuit element in which there is no emf generated.

8.29 Parallel Circuits — Shunt Circuits — Electric or magnetic circuits are said to be in parallel (or shunt) when the current or flux is divided between them.

8.30 Peltier Effect —- The production or absorption of heat due to the passage of current across the junction of two different metals or alloys.

8.31 Polarization Current — The current caused by the variation of the dielectric polarization.

8.32 Resistance (in Direct Current) — The constant difference of potential applied to the ends of a conductor, divided by the current it produces, when the conductor has no emf acting therein.

8.33 Resistivity —The resistance of a wire of a given substance multiplied by the cross-sectional area of the wire and divided by its length.

8.34 Rheostriction — Pinch Effect — The phenomenon of transverse contraction of a liquid conductor due to the mutual attraction of the different-parts carrying currents.

8.35 Series Circuits — Circuits connected so that the same current flows through them.

8.36 Skin Effect — Kelvin Effect — Non-uniform distribution of variable currents in solid conductors resulting in an increase in the current density near the surface.

8.37 Thermoelectric Effect — Seebeck Effect — The production of an emf due to a difference of temperature between two junctions of different metals or alloys forming part of the same circuit.

8.38 Thomson Effect — The production of an emf in the parts of a homogeneous conductor which are at different temperatures.

8.39 Unidirectional Current — A current which always maintains the same direction.

8.40 Volta Effect — The production of an emf by the contact of dissimilar metals having the same temperature.

8.41 Voltage — Potential Difference — The line integral from one point to another of an electric field, taken along a given path.

8.42 Voltage (Potential) Drop — The diminution of potential along a conductor or in an apparatus through which a current is passing.

9. ELECTRIC DISCHARGE IN GASES

9.1 Anode Glow — Positive Glow — A luminous phenomenon which accompanies an electric discharge in a gas under certain conditions of pressure and distance between the electrodes. It appears on the anode, or near it, and is separated from cathode phenomena by the Faraday dark space.

9.2 Arc — A luminous discharge of electricity across a gas, characterized by a large current and a low voltage gradient, often accompanied by partial volatilization of the electrodes.

9.3 Brush Discharge — An intermittent discharge of electricity, having the form of a mobile brush which starts from a conductor when its potential exceeds a certain value, but remains too low for the formation of an actual spark. It is generally accompanied by a whistling or crackling noise.

9.4 Corona Effect — The particular form of the glow discharge in the case of electric lines or apparatus working at high voltage.

9.5 Flashover — The passage of a disruptive discharge round an insulating material.

9.6 Glow Discharge — The phenomenon of electric conduction in gases shown by a luminosity, without great hissing of noise, and without appreciable heating or volatilization of the electrodes, when the field strength exceeds a certain value.

9.7 Leakage Path (Electric) — The shortest distance across the **surface** of a piece of insulating material between two points at different potentials.

9.8 Magnetic Blow-Out — An effect produced by the action of a magnetic field on an electric current, used to extinguish or modify an arc.

9.9 Puncture — The passage of a disruptive discharge through an insulating material.

9.10 Spark — A brilliantly luminous phenomenon of short duration, which characterizes a disruptive discharge.

9.11 Striking (an Arc, a Spark) — Variable conditions during which an arc or a spark is established.

10. MAGNETISM

10.1 Absolute Permeability (of a Substance or of an Isotropic Medium) — The magnetic flux density divided by the magnetic field strength.

10.2 Coercive Force — The magnetic force necessary to bring the flux density of a ferromagnetic body to zero after it has been previously magnetized.

10.3 Consequent Pole — A pole in a magnetic substance resulting from the meeting of two.

10.4 Coulomb's Law — The law according to which the force exerted between two point magnetic masses in a homogeneous, isotropic medium of infinite extent and constant permeability, is proportional to these poles and inversely proportional to the square of the distance between them.

10.5 Curie Point — The critical temperature above which a ferromagnetic body is paramagnetic.

10.6 Demagnetization Factor — The factor by which the average intensity of magnetization of a ferromagnetic bar in a uniform field must be multiplied in order to obtain the value of the demagnetizing field.

10.7 Demagnetizing Field — Internal field of a magnet, the direction of which is generally opposed to that of the magnetic inductance and resulting from the distribution of the magnetic masses of this magnet.

10.8 Diamagnetic Substanoe — A substance which becomes magnetized, always weakly, by an external magnetic field, the magnetization having the effect of reducing the induction due to the field alone.

10.9 Differential Susceptibility and Permeability — The rate of change of the magnetization or of induction with respect of the magnetic field.

10.10 Ferromagnetic Substance — A substance which may be magnetized to a considerable extent in an external magnetic field and which retains the whole or part of this magnetization after the effect of the field has ceased.

10.11 Hysteresis Loop — A closed curve representing the change of the magnetic induction or of the intensity of magnetization in a ferromagnetic body, when the magnetic force undergoes a periodic variation.

10.12 Initial Susceptibility and Permeability — Limiting value of susceptibility and of permeability of a ferromagnetic body at the origin of the curve of first magnetization.

10.13 Intensity of Magnetization — Magnetisation — A vector associated with an element of a substance and equal in size and direction to the magnetic moment of this element divided by its volume.

10.14 Magnet — Permanent Magnet - A ferromagnetic body which maintains a magnetic field without the aid of external electric currents

10.15 Magnetic Axis — The magnetic axis of a magnet coincides in direction and sense with the axis of its magnetic moment

10.16 Magnetic Declination — The angle included between the magnetic meridian and geographic meridian at a point on the earth's surface.

10.17 Magnetic Field — A region of space in which there exists a magnetic state associated with forces.

10.18 Magnetic Field Strength — An auxiliary vector point-function that measures the ability of electric currents or magnetized bodies to produce magnetic induction (B).

10.19 Magnetic Flux — Flux of the magnetic induction.

10.20 Magnetic Flux Density — Magnetic Induction — Magnetic induction is the basic observable property of a magnetic field. It is directly associated with the force on a current element on the electromotive force induced in a moving conductor.

10.21 Magnetic Hysteresis — The phenomenon by which the magnetization of ferromagnetic bodies depends, not only on the actual value of the field at a given instant, but also on the previous magnetic state.

10.22 Magnetic Inclination — The acute angle between the horizontal plane and the direction of the earth's magnetic field.

10.23 Magnetic Meridian — The intersection of the earth's surface with a vertical plane which lies in the direction of the earth's magnetic field.

10.24 Magnetic Moment of a Constant Current — An axial vector quantity associated with an electric circuit such that its projection on to any directional axis is equal to the current multiplied by the area enclosed by the projection of the circuit on to a plane normal to the direction of this axis.

10.25 Magnetic Moment of a Magnet — A vector associated with a magnet such that, when the magnet is immersed in a homogeneous magnetic field, mechanical action on the magnet is shown by a couple of which the mechanical torque is equal to the vector product of the magnetic moment of the magnet and the magnetic induction. This magnetic moment is equal to the Vector sum of the elementary magnetic moments of the separate currents which produce the magnetization.

10.26 Magnetic Poles of a Magnet — Points situated near the ends of the magnet where it may be considered that two magnetic masses are situated, such that their resultant field, at a distance point, is approximately the same as that of the magnet.

10.27 Magnetic Potential — A pseudoscalar quantity existing only outside those spaces where the current density (with the true sense: conduction, displacement, convection) is not zero and the gradient of which (with sign reversed) represents the magnetic field.

10.28 Magnetic Shell — A magnet in the form of an infinitely thin shell in which the magnetization is everywhere normal to the surface and in inverse ratio to the thickness.

10.29 Magnetic Viscosity — Magnetic Creep — Phenomena by reason of which changes in magnetization of a ferromagnetic substance follow the changes in the field which produces them, with a time-lag depending on the speed of variation of the field.

10.30 Magnetism — That part of science which deals with magnetic fields and of bodies influenced by them.

10.31 Magnetisation — An operation by which a ferromagnetic body is given the properties of a magnet. A term sometimes used as a synonym for intensity of magnetization.

10.32 Magnetising Current — Current principally for producing a magnetic field.

10.33 Magnetizing Field —A magnetic field used to produce magnetization.

10.34 Magnetostriction—The phenomenon of elastic deformation which accompanies magnetization.

10.35 Neutral State — The state of a ferromagnetic substance which has not-yet been magnetized (virgin state) or which has been artificially brought back to that state.

10.36 Normal Induction - The induction value obtained from the curve of normal magnetization. In practice, when the term induction is used without any qualification in connection with ferromagnetic materials, normal induction is implied.

10.37 Normal Magnetization Curve — The line joining the tips of different hysteresis loops obtained by varying the limits of the magnetizing field.

10.38 Normal Permeability — Permeability corresponding to normal induction. In practice, when the term permeability is used without any qualification in connection with ferromagnetic materials, normal permeability is implied.

10.39 Paramagnetic Substance — A substance which becomes magnetized, generally weakly, in an external magnetic field, the effect of the magnetization being to increase the induction due to the field alone.

10.40 Polarization—A vector associated with an element of substance and equal in size and direction to the magnetic moment of this element divided by its value.

10.41 Relative Permeability — The ratio of the absolute permeability of a substance or medium to that of a vacuum.

10.42 Residual Flux Density — The value of flux density persisting after the magnetizing force has been removed.

10.43 Residual Magnetism — A property of ferromagnetic bodies by which they retain a certain magnetization (induction) after the magnetizing force has been removed.

10.44 Residual Magnetisation — Remanence — The magnetization which persists in a ferromagnetic body after the magnetizing force has been removed.

10.45 Saturation — The state of a ferromagnetic substance placed in a field so strong that the intensity of magnetization becomes independent of the field; the substance is then said to be saturated.

In a wider sense, a ferromagnetic substance is said to be more or less saturated according to whether its magnetization is more or less closed to saturation.

10.46 Strength of Shell —The product of the magnetization by the thickness of the shell.

10.47 Susceptibility — The ratio of the magnetization of an isotropic substance to the magnetic field producing it.

10.48 Terrestrial Magnetic Field —The natural magnetic field which exists in the terrestrial region.

10.49 Terrestrial Magnetic Poles — The points on the earth's surface where the magnetic inclination is 90 degrees.

10.50 To **Demagnetize** — To restore to its neutral condition a magnetized ferromagnetic body.

10.51 To Magnetize — To give a ferromagnetic body the properties of a magnet.

11. ELECTROMAGNETISM — ELECTRODYNAMICS

11.1 Air Gap — The short gap between the ferromagnetic parts of a magnetic circuit,

11.2 Armature of an Electromagnet — Keeper — A piece of magnetic material so placed that it can be moved by the magnetic action of the electromagnet.

11.3 Armature of a Permanent Magnet —The piece of iron which is placed against the ends of a permanent magnet, to diminish the reductance and preserve the magnetization.

11.4 Biot and Savart's Law — The law which gives the magnetic field produced at a point by an element carrying an electric current.

11.5 Coefficient of Inductive Coupling Between Two Circuits — The ratio of the mutual inductance to the geometric mean of the two self-inductances.

11.6 Electrodynamic — An adjective applied to the action or force exerted between electric currents.

11.7 Electrodynamics — That part of science which deals with forces between conductors carrying currents.

11.8 Electromagnet — A device consisting of a ferromagnetic core and coil, which produces appreciable magnetic effects only when an electric current flows through the coil.

11.9 Electromagnetic Induction — The production of electromotive force:

a) In a closed circuit, by the variation magnetic flux linking it; **and**

b) In an element of a movable circuit, by the lines of magnetic flux that it cuts.

11.10 Electromagnetism — That part of science which deals with the relations between electricity and magnetism.

11.11 Excitation - The production of magnetic flux through a magnetic circuit by meant of an electric current; the term is sometimes used as a synonym for the magnetomotive force producing the flux through an electromagnet.

11.12 Faraday's Law — The fundamental law of electromagnetic induction which states that the emf induced in a closed circuit is proportional to the rate of change of the flux linked by the circuit. The sign is given by the Lenz's law.

11.13 Ideal Solenoid — A cylindrical coil of which all the turns are assumed to be in planes normal to the axis and equally spaced; in practice of the name solenoid is given to a cylindrical coil wound in a. spiral of fine pitch.

11.14 Laplace's Law — The law which gives the force exerted on an element carrying a current placed in a magnetic field.

11.15 Lens's Law — The law which states that the induced emf tends to produce a current in such a direction that it will oppose the cause by which it has been produced.

11.16 Magnetic Circuit — A combination of media, mainly comprising ferromagnetic substance, forming a closed circuit, and through which a flux of magnetic induction may pass.

11.17 Magnetic Core — That part of a magnetic circuit surrounded by a coil.

11.18 Magnetic Potential Difference — The line integral of the magnetic field intensity between two points.

11.19 Magnetomotive Force (Along a Closed Curve) — The line integral of magnetic field strength around the curve.

11.20 Mutual Inductance — The magnetic flux which the current flowing in one circuit induces in another circuit, divided by the current in the first circuit.

11.21 Mutual Induction (Between Circuits) — The induction of an emf in one circuit by the change in the current flowing through another circuit.

11.22 Permeance — The reciprocal of reluctance.

11.23 Reluctance — The magnetomotive force applied to a magnetic circuit divided by the flux established in it.

11.24 Self-Inductance — Coefficient of Self-induction — For a closed circuit, the total magnetic flux linked by it divided by the current flowing through it, or the total magnetic energy stored, divided by half the square of the current flowing through it.

11.25 Self-induction — The induction of an emf in the circuit itself by the change in the current flowing through it.

11.26 Solenoid — A coil usually of tubular form for producing a magnetic field.

11.27 Yoke — The piece of ferromagnetic material, not surrounded by windings, used to connect the cores of an electromagnet or of a transformer or the poles of a machine.

12. UNITS AND SYSTEMS OF MEASUREMENT

12.1 Absolute Electrical Units

Ampere (unit of electric current) — A constant current which, flowing in two parallel straight conductors of infinite length, of negligible cross-section and placed at a distance of one metre apart in a vacuum will produce a force of 2×10^{-7} newton per metre length between the conductors.

Coulomb (unit of quantity of electricity) — The quantity of electricity conveyed in one second by a current of one ampere.

Farad (unit of electric capacitance) — The capacitance of an electric capacitor having a difference of electric potential of one volt between the plates, when it is charged with a quantity of electricity of one coulomb.

Henry (unit of electric inductance) — The inductance of a closed circuit in which an emf of one volt is produced when the current in the circuits varies at the uniform rate of one ampere per second.

Okm (unit of electrical resistance) — The electrical resistance between two points of a conductor when a constant potential difference of one volt, applied to these points, produces a current of one-ampere in the conductor, provided no emf is generated in the conductor.

Volt (unit of potential difference and emf) — The difference of electric potential which exists between two points of a conductor carrying a constant current of one ampere, when the power dissipated between these points is one watt.

Weber (unit of magnetic flux) — The magnetic flux which, linked with a circuit composed of a single turn produces in it an emf of one volt if it is uniformly reduced to zero in one second.

12.2 Absolute System of Electrical Units — System of units based on an electrodynamic definition of the intensity of current.

12.3 Barye — The cgs unit of pressure which is equal to one dyne per square centimetre, and which was adopted at the International Congress on Physics in 1900.

12.4 cgs System — A system in which the centimetre, gram and second are the fundamental units of length, mass and time.

12.5 Cycle Per Second — Hertz — The unit of frequency based on the second as unit of time.

12.6 Derived Units — The units deduced from the fundamental units.

12.7 Dyne (the cgs Unit of Force) — The force which produces on a mass of one gram an acceleration of one centimetre per second per second.

12.8 Electromagnetic cgs Units

Quantity	*Name*
magnetic field strength	oersted
magnetic flux density	gauss
magnetic flux	maxwell
magnetomotive force	gilbert

12.9 Electromagnetic System — A system of units for electrical and magnetic quantities in which the permeability of a vacuum is taken as dimensionless and equal to unity.

12.10 Electrostatic System — A system of units for electrical and magnetic quantities in which the permittivity of a vacuum is taken as dimensionless and equal to unity.

12.11 Erg (the cgs Unit of Work) — The work done by a force of one dyne when its point of application is moved through one centimetre in the direction of the force.

12.12 Fundamental Units — The units which are considered as independent and are chosen arbitrarily to serve as a basis for a system of units.

12.13 Giorgi System — MKSA System — A system in which the principal units are the metre, the kilogram, the second and the ampere.

12.14 Newton — The force which produces on a mass of one kilogram an acceleration of one metre per second per second.

12.15 Practical Electrical Units — The figures in the column ' Conversion Ratio ' give the ratio of the electromagnetic cgs unit to the practical unit and to the Giorgi unit.

Quantity	*Name*	*Conversion Ratio*
resistance	ohm	10^{-9}
voltage	volt	10^{-8}
current	ampere	10
quantity of electricity	coulomb	10
capacitance	farad	10^{-9}
inductance	henry	10^{-9}
magnetic flux	weber	
energy	joule	10^{-7}
power	watt	10^{-7}
reactive power	var	
apparent power	volt-ampere	10^{-7}

12.16 Practical System — A system in which the integral units are multiples or sub-multiples in powers of 10 of the corresponding units in the electromagnetic cgs system. Proper names have been given to some of these units.

12.17 Unit Magnetic Mass in the Electro-Magnetic System —A magnetic mass which, when concentrated at a point in a vacuum at a distance of one centimetre from an identical pole, repels it with a force equal to one dyne.

12.18 Unit Quantity of Electricity in the Electrostatic System — The quantity of positive or negative electricity which, when concentrated at a point in a vacuum at distance of one centimetre from an identical charge, repels it with a force equal to one dyne.

12.19 Usual Practical Units — Units which are not actually included in the practical units derived from the cgs system, but which are commonly used. The following units fall under this category:

Ampere Hour — The quantity of electricity which flows if a current of one ampere passes for one hour, and is equal to 36 000 coulombs.

Ampere Turn — The magnetomotive force produced by one ampere flowing through a single turn of a conductor.

Volt-Ampere-Hour — The unit of apparent energy in the practical system, equal to one watt.

Watt-Hour — The electrical energy developed during one hour by a power of one watt and is equal to 36 000 joules

13. CIRCUIT CHARACTERISTICS

13.1 *Admittance — The current flowing in a circuit divided by the terminal voltage. The reciprocal of the impedance.

13.2 Balanced Polyphase System (of Quantities) — A system of n circuits having equal vector impedance and designed so that n currents flow through them to form a balanced polyphase system. In a 3-phase system n equals three.

13.3 Bifilar Winding — A winding consisting of two insulated wires arranged side by side, so that the current travels through them in opposite directions.

13.4 *Capacitive Reactance — The reciprocal (with negative sign) of the product of the capacitance and the angular frequency.

13.5 *Complex Admittance — A complex quantity having the scalar value of the admittance as its modulus and the phase displacement between voltage and current as argument. The argument is positive when the current leads the voltage.

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*This definition is a applicable only to sinusoidal current.

13.6 *Complex Impedance — A complex quantity having the scalar value of the impedance as its modulus and the phase displacement between current and voltage as its argument. The argument is positive when the voltage leads the current.

13.7 *Conductance — The component of current in phase with the terminal voltage of a circuit, divided by that voltage.

13.8 Connections of Circuits

Series — An arrangement of elements so that they all carry the same current or flux.

Parallel — Electric or magnetic circuits are said to be in parallel (or shunt) when current or flux is divided between them.

Series Parallel— An arrangement of elements of which some are connected in series and others in parallel.

13.9 Connections of Polyphase Circuits

Mesh — Connection in series of the windings of a polyphase system, effected in such a manner as to form a closed circuit.

In a 3-phase system this is called the delta connection.

Star — The connection of polyphase apparatus so arranged that one end of each of the windings, conductors or apparatus corresponding to each phase is connected to a common point, the other end being connected to the corresponding conductors of the distribution system. In a 3-phase circuit this is sometimes called a Y connection.

Zig-Zag or Interconnected Star — The connection in star of polyphase windings, each branch of which is made up of windings that generate phase-displaced voltage.

13.10 Contact Resistance — The potential difference between two surfaces in 'contact, divided by the current flowing between them in the absence of any local emf.

13.11 Diametral Voltage of a Polyphase System (with an even number of equal phases) — The largest of the voltages between lines of such a system.

13.12 Differential Winding — Term used to describe a system comprising two windings through which two distinct currents flow, and the electromagnetic effects of which are in opposite directions (for example differential galvanometer).

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*This definition is applicable only to sinusoidal current.

13.13 Earth — Ground — The conducting mass of the earth or a conductor connected to it through a very small impedance.

13.14 Earthed Circuit — An assembly of conductors of which one or more points are permanently connected to earth.

13.15 Earth Electrode — A conductor or a combination of conductors buried in the earth in order to make a connection therewith.

13.16 Earth Fault — Accidental connection of a conductor to earth. When the impedance is negligible, the connection is called a 'dead earth'.

13.17 Earth Leakage Current — The current flowing to earth on account of imperfect insulation.

13.18 *Effective Reactance — The component of the voltage in quadrature with the current divided by the current.

13.19 Effective Resistance — Resistance to Alternating Current — Ratio of the power dissipated to the square of the rms value of the current. For sinusoidal current this is equal to the component of the voltage in phase with the current, divided by the current.

13.20 *Impedance — The terminal voltage of a circuit divided by the current flowing through it.

13.21 *Inductive Reactance — The product of the inductance and the angular frequency.

13.22 Insulation Fault — An abnormal decrease in insulation resistance.

13.23 Insulation Resistance — The resistance under specified conditions between two conductors or system of conductors normally separated by an insulating material.

13.24 Multi-Frequency System — A system in which currents of different frequencies are superimposed.

13.25 Neutral Point

a) The common point of the star in a polyphase system.

b) The point of a symmetrical system which is normally at zero potential and is often directly connected to earth.

13.26 Neutral Terminal (of a Polyphase Machine or Transformer) — The terminal connected to the neutral point of a polyphase machine or apparatus which is star connected.

13.27 Phase Voltage of a Winding (of a Machine or Apparatus) — The potential difference across one phase of the machine or **apparatus.**

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*This definition is applicable only to sinusoidal current.

13.28 Polygonal Voltage of a Polyphase System — The smallest of the voltages between lines of such a system.

13.29 Polyphase System (of Circuits) - A system of circuits, each carrying one of the currents of a polyphase system of currents.

13.30 Polyphase System (of Quantities) in Equilibrium — Symmetrical Polyphase System (of Quantities) — A system of n sinusoidal quantities with the same frequency and the same effective value and such that the phase difference between two consecutive ones is a multiple of the angular interval $\frac{2\pi}{n}$.

13.31 Polyphase System (of Quantities, Voltages, Currents) — System comprising n sinusoidal quantities of the same kind, having the same frequency and having a phase displacement between them.

13.32 Resistance of an Earthed Conductor — Earth Resistance — The potential difference between the conductor and the mass of the earth at a reasonably distant point divided by the current in the conductor.

13.33 Resistance per Unit Length — Term used for the insulation of an insulated conductor (wire or cable) related to a certain fixed length.

13.34 Short Circuit — The intentional or accidental connection of two points of a circuit through a negligible impedance. The term is often applied to the group of phenomena which accompany a short circuit between points at different potentials.

13.35 Single-Phase System — A system supplied from a single alternating voltage.

13.36 Single-Wire Circuit — A circuit consisting of a single wire, the return being through the earth, or frame.

13.37 *Susceptance— The component of current in quadrature with the terminal voltage of a circuit, divided by that voltage.

13.38 The Order of a Polyphase Symmetrical System of Quantities—The number of times that the angular intervals between two vectors bearing successive numbers if contained in the complete circle.

Example:

If there are m intervals between vectors V_p and $V_p + 1$ the order of the polyphase system is m.

13.39 To Close (Open) a Circuit — To establish (break) a conducting connection which allows current to pass. v

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*This definition is applicable only to sinusoidal current.

13.40 To Connect to Frame — To connect a conductor to the frame of a machine or to the mass of metal which serves as an earth.

13.41 To Earth — To connect a conductor to earth.

13.42 Two-Phase System — A system comprising two sinusoidal quantities of the same effective value but with a phase displacement $\frac{\pi}{2}$ between them.

13.43 Voltage Between Lines of a Polyphase System — The voltage between two different line conductors of a polyphase system. When the number of phases is greater than 3, there are a number of values of line voltage.

13.44 Voltage to Neutral — The voltage between a line conductor of a polyphase system and a real or artificial neutral point.

14. MACHINE OPERATING CONDITIONS

14.1 Acceptance Tests — The whole of the tests carried out in the presence of the customers representative in order to check the quality of the units of one consignment.

14.2 * Active Current — The component of the alternating current which is in phase with the electromotive force or voltage.

14.3 Active Power— The mean power in an alternating current circuit. With sinusoidal currents it is equal to the product of the voltage or emf by the active current.

14.4 Apparent Power — The product of the rms current by the rms electromotive force or voltage.

14.5 Balance Load — A load distributed equally between conductors or groups of conductors in a system with several wires or phases.

14.6 Characteristic Curves — Curves which show the relations between certain quantities used in the study of machines and electrical apparatus.

14.7 * Complex Power — An expression in which the active power is the real part and the reactive power, with sign reversed, is the imaginary part.

14.8 Continuous Duty — Duty at constant rating.

14.9 Duty (of a Machine or Apparatus) — A statement of the operating conditions to which the machine or apparatus is subjected, their respective duration and their sequence in time.

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*This definition is a applicable only to sinusoidal current.

14.10 *Fluctuating Power — A vector quantity of which the vector represents the alternating part of the power, and which rotates at a speed equal to double the angular velocity of the current.

14.11 Load — The true or apparent power given or absorbed by a machine or distribution network.

14.12 Magnetizing Current — The current necessary to produce the magnetic flux in a machine or apparatus.

14.13 No-load Operation — The operation of a machine, transformer or other apparatus when it absorbs power without providing any.

14.14 Nominal Load — Full Load — The power for which a machine has been designed.

14.15 Operating Conditions — The whole of the electrical and mechanical quantities which characterize the working of a machine, apparatus or supply network, at a given time.

14.16 Over-Current — An abnormal current greater than the full load.

14.17 Over-Load — The excess of the actual load over the nominal load.

14.18 Over-Voltage — An abnormal voltage higher than the service voltage.

14.19 Power Factor — The ratio of the active power to the apparent power.

14.20 Prototype Tests — The whole of the tests carried out on **a** single apparatus (or machine) or on several pieces of apparatus of the same type to ensure that the apparatus under test satisfies the specified working and all the conditions laid down, as regards design, dimensions, quality of the principal materials and workmanship.

14.21 Rated Current (of a Machine or Apparatus) — The value of the current which is used in the specification of a machine or apparatus and from which the conditions of temperature rise, as well as the operation of the machine or apparatus, are calculated.

14.22 Rated Duty —That duty to comply with which the particular machine or apparatus has been designed.

14.23 Rated Frequency (of a Machine or Apparatus) —The frequency used in the specification of the apparatus and from which the test conditions and the frequency limits for the use of the machine or apparatus are calculated.

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*This definition *is* applicable only to sinusoidal current.

14.24 Rated Quantity (of a Machine or Apparatus) — The rated current, voltage, frequency, etc, of a machine or apparatus of which the numerical value is included in the definition of 'rating'.

14.25 Rated Voltage (of a Machine or Apparatus) — The voltage used in the specification of a machine or apparatus and from which the test conditions and the voltage limits for the use of the machine or apparatus are calculated.

14.26 Rating — The whole of the electrical and mechanical quantities assigned to the machine, apparatus, etc, by the designer, to define its working in specified conditions indicated on the rating plate.

14.27 Rating Plate — A plate affixed to a machine or apparatus giving its rated data and the values of the quantities corresponding to rating.

14.28 Reactive Current — The component of a current in quadrature with the electromotive force or voltage.

14.29 Reactive Power — The product of the voltage or emf by the reactive current. The reactive power of an inductive load is positive.

14.30 Service Conditions — Extraneous factors (altitude, temperature of the ambient air, voltage variations, etc) which may affect the working of a machine or apparatus.

14.31 Short-Time Duty — Duty at constant load during a given time less than that required to obtain constant-temperature in continuous duty at the same load, followed by a rest of sufficient duration to re-establish equality of temperature with the cooling medium.

14.32 Temperature Coefficient

a) Between two given temperatures (mean coefficient) — the relative variation of the quantity considered, divided by the difference in temperature producing it.

b) At a given temperature — the limiting value of the mean coefficient when the difference in temperature is very small.

14.33 Temperature-Rise — The difference between the temperature at a point under consideration and a reference temperature.

14.34 Transient Phenomena — Phenomena appearing during the transition from one operating condition to another.

14.35 Type of Duty — A typical duty consisting of one or more constant operating conditions for specified durations.

14.36 Uninterrupted Duty — Duty with load with no intervals of rest.

14.37 Value (of a Quantity Corresponding to Rating) — The numerical value of a quantity which is not included in the definition of the rating but is associated with it. For example, the current has a rated value in the case of generators, but a value corresponding to the rating in the case of motors. The speed has a rated value in the case of synchronous machines, but a value corresponding to the rating in the case of induction machines.

14.38 *Vector Power — The vector representing the complex power.

15. SYMMETRICAL COMPONENTS AND CO-ORDINATES

15.1 Component of a Symmetrical System — One of the quantities constituting a symmetrical polyphase system.

15.2 Cyclic Admittance (of a Symmetrical Polyphase Winding) — The reciprocal of the cyclic impedance.

15.3 Cyclic Impedance (of a Symmetrical Polyphase Winding) — The potential difference across the terminals of a phase divided by the current flowing in it, a balanced polyphase system of currents flowing in the different phase of the winding.

15.4 Cyclic Reactance (of a Symmetrical Polyphase Winding) — Reactance corresponding to the cyclic impedance.

15.5 Degrees of Unbalance in a Three-Phase System — Dissymmetry (Asymmetry) — Ratios between the rms values of the negative sequence (dissymmetry) or zero sequence (asymmetry) co-ordinate and the positive sequence co-ordinate.

15.6 Fluctuating Power of a Polyphase System — The sum of the fluctuating powers per phase.

15.7 Positive Sequence (or Negative Sequence) Components of System of Three-Phase Quantities — One of the quantities which constitute the positive (negative) co-ordinates of the system.

15.8 Positive Sequence (or Negative Sequence) Co-ordinate of a System of Three-Phase Quantities — A symmetrical co-ordinate of which the component with index 2 lags (leads) in phase by $2\pi/3$ in relation to that with index 1.

15.9 Positive Sequence (or Negative Sequence) Polyphase System — A polyphase system in which the quantity numbered ($p + 1$) lags (leads) in phase in relation to the quantity numbered p.

15.10 Positive Sequence (or Negative Sequence) (Homopolar) Power in a Three-Phase System.

a) *Per Phase* — power resulting from the action of a positive sequence (negative sequence) (homopolar) component of the voltages with the corresponding positive sequence (negative sequence) (homopolar) component of the current.

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*This definition is applicable only to sinusoidal current.

b) *Of a Three-Phase System* — three times the positive sequence (negative sequence) (homopolar) power per phase.

15.11 Positive Sequence (or Negative Sequence) Polyphase System of Order m — A positive sequence (or negative sequence) system in which the vectors representing quantities bearing successive numbers are separated by *m* angular intervals.

15.12 Symmetrical Co-ordinates in a System of Unbalanced Polyphase Quantities — Systems of polyphase symmetrical quantities into which it is possible to resolve an unbalanced polyphase system.

15.13 Synchronous (Asynchronous) Single-Phase Impedance (Admittance, Reactance) — Impedance (admittance, reactance) in a system of balanced positive sequence (negative sequence) (homopolar) currents.

15.14 Zero-Sequence (Homopolar) Component — One of the quantities which constitute the zero-sequence (homopolar) co-ordinate.

15.15 Zero-Sequence or Homopolar Co-ordinate of a System of Polyphase Quantities — The symmetrical components of the system formed by *n* co-ordinates which are identical in magnitude and phase.

16. APPARATUS AND ACCESSORIES

16.1 Amplifier — Apparatus used to increase the amplitude of a phenomenon by means of energy drawn from an external source.

16.2 Bank of Capacitors — A group of several similar capacitors connected electrically.

16.3 Damper — A system which offers to certain movements of a body a resistance depending on its speed.

16.4 Electrolytic Capacitor — A capacitor which consists of two electrodes immersed in a liquid, the electrolytic decomposition of which produces an insulating layer, which gives an appreciable electric capacitance to the system.

16.5 Four-Terminal Network — Any group of impedances, possibly containing a source of emf which can only exchange electric power with external systems by their input and output connections, both of which comprise two terminals.

16.6 Full-Wave Rectifier — A single-phase rectifier which supplies a unidirectional current, composed of two half waves per period of the alternating current.

16.7 Half-Wave Rectifier — A single-phase rectifier which supplies a unidirectional current comprising only one half-wave for each period of the alternating current.

16.8 Inductor — Apparatus which is used specially because of its inductance.

16.9 Input of a Four-Terminal Network — The terminals of a four-terminal network through which it normally receives energy.

16.10 Insulator — An element used to insulate a conductor or apparatus and generally as a support.

16.11 Oscillator — Apparatus intended to produce or capable of maintaining electrical or mechanical oscillations.

16.12 Output of a Four-Terminal Network — The terminals of a four-terminal network through which it normally supplies energy to the utilization circuit.

16.13 Passive Four-Terminal Network — A four-terminal network, not containing any source of emf.

16.14 Rectifier — Apparatus used to obtain, from an alternating emf a unidirectional current comprising only one half-wave for each period of the alternating current.

16.15 Relay — A device which responds to a certain change in an electrical circuit with the object of causing given changes in the same or in another electrical circuit, the circuit directly acted upon being a control or a signalling circuit.

16.16 Resistor — An assembly of conductors which is used specially because of its resistance.

16.17 Resonator — An apparatus or system capable of vibrating by resonance with another oscillator.

16.18 Rheostat — An apparatus which consists of variable resistors.

16.19 Search Coil — A coil intended to measure magnetic flux by the phenomenon of induction.

16.20 Two-Terminal Network — Any group of impedances, possibly containing a source of emf connected to an external system by two terminals only.

16.21 Variable Capacitor — A capacitor of which the capacitance may be varied, for example, by moving one of the plates in relation to the other.

INDEX

NOTE — This index has been prepared in accordance with IS : 1275-1958 Rules for Making Alphabetical Indexes. The index numbers in this index refer to clause numbers.

***irt* = *in* relation to**

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